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TECHNICAL NOTE

PINEWOOD NEMATODE IN THE FOREST TREES IN THE MARITIME PROVINCES OF CANADA

A load of low-grade eastern white pine lumber from Nova Scotia was found infested by pinewood nematode on arrival at Turku, Finland in December 1989. This is the first time pinewood nematode has been found in exported Canadian lumber. The shipment was impounded by Finnish Plant Quarantine officials.

Excerpts from articles in:

The Daily Gleaner, Fredericton, N.B. January 16, 1990
The Telegraph-Journal, Saint John, N.B. January 13, 1990
The Chronicle Herald, Halifax, N.S. January 11, 1990

News of the discovery of pinewood nematode in exported Canadian lumber spread alarm throughout the lumber industry, especially in the Maritimes from whence the infested shipment originated. Being a plant quarantine pest, the presence of pinewood nematode in sawn lumber could seriously affect international trade or the way lumber must be handled before shipment.

The presence of pinewood nematode in the Maritime forests was first reported by the Forest Insect and Disease Survey of Forestry Canada at the end of the 1986 field season (Magasi, 1987).

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In Canada, pinewood nematode (Bursaphelenchus xylophilus (Steiner and Buhrer) Nickle) has been known to occur in two forms: the "r" form, isolated mostly from pines, and the "m" form, which, in the Maritimes, is isolated exclusively from balsam fir or spruce trees. Recent research has shown that, even though the two forms can be differentiated morphologically (although at times with considerable difficulty), they are closely related on the basis of genetics, biology, and (at least in the laboratory, in seedling inoculation experiments) pathogenicity, and are part of the B. xylophilus complex.

This report is a summary of information presented in various reports by the Forest Insect and Disease Survey over recent years as it relates to the situation in the Maritime provinces.

The pinewood nematode has gained worldwide attention in recent years, mostly because of its implications for international trade of forestry products.

Nematodes are a class of "elongated, cylindrical worms, parasitic in animals or plants or free-living in soil or water" (Webster's Seventh New Collegiate Dictionary, 1970). The pinewood nematode was first identified in North America in the late 1970s and was believed to have been imported from Japan, where it has been reported to have killed trees for at least 30 years. The pinewood nematode is reported to be widely distributed in the United States and was first reported in Canada in southern Manitoba in 1982. Since then, it has been found in most (but not all) Canadian provinces.

The pinewood nematode is a plant-parasitic species which kills trees by rapidly multiplying in the water-conducting elements, after having been introduced into the trees by some wood-boring insect, such as the sawyer beetle (Monochamus sp.). The actual vectors are not known but cerambycids are suspected. The affected tree, with its water supply cut off, wilts and dies within a short time. The fact that many species of nematodes may be present in trees, most of them not pathogenic, and that the identification of these microscopic organisms is extremely difficult, has resulted in considerable confusion as to the cause of tree mortality in some areas and as to the actual distribution of the pinewood nematode itself.

In the Maritimes, the pinewood nematode has been of special concern to the Forest Insect and Disease Survey since 1980. Through general observations, forest condition assessment surveys, plantation surveys, pest extension activities, provincial cooperative surveys, and special surveys, staff have been on the lookout for symptomatic suspect trees. In the six years from 1980 to mid-1985, 17 such trees were located. These included red pine, Scots pine, white spruce, and balsam fir. Nematodes were extracted from some of these but none were of the pinewood nematode, according to expert opinion.

Because of the plant quarantine importance of pinewood nematode, extensive surveys have been underway to detect its presence in trees since 1985 and in its possible vectors (carriers) in 1988.

Tree surveys - 1985-1989

In the fall of 1985, and during subsequent summers, a special survey was conducted in the Maritimes as part of a national effort to establish the presence and distribution of the pinewood nematode in Canada. Recently dead, old dead, and a few living trees were sampled and analyzed. Samples were obtained from 228 locations, 147 in New Brunswick, 55 in Nova Scotia, and 26 in Prince Edward Island. The distribution of sampling areas and results are shown in Figure 1, the various hosts sampled in Table 1.

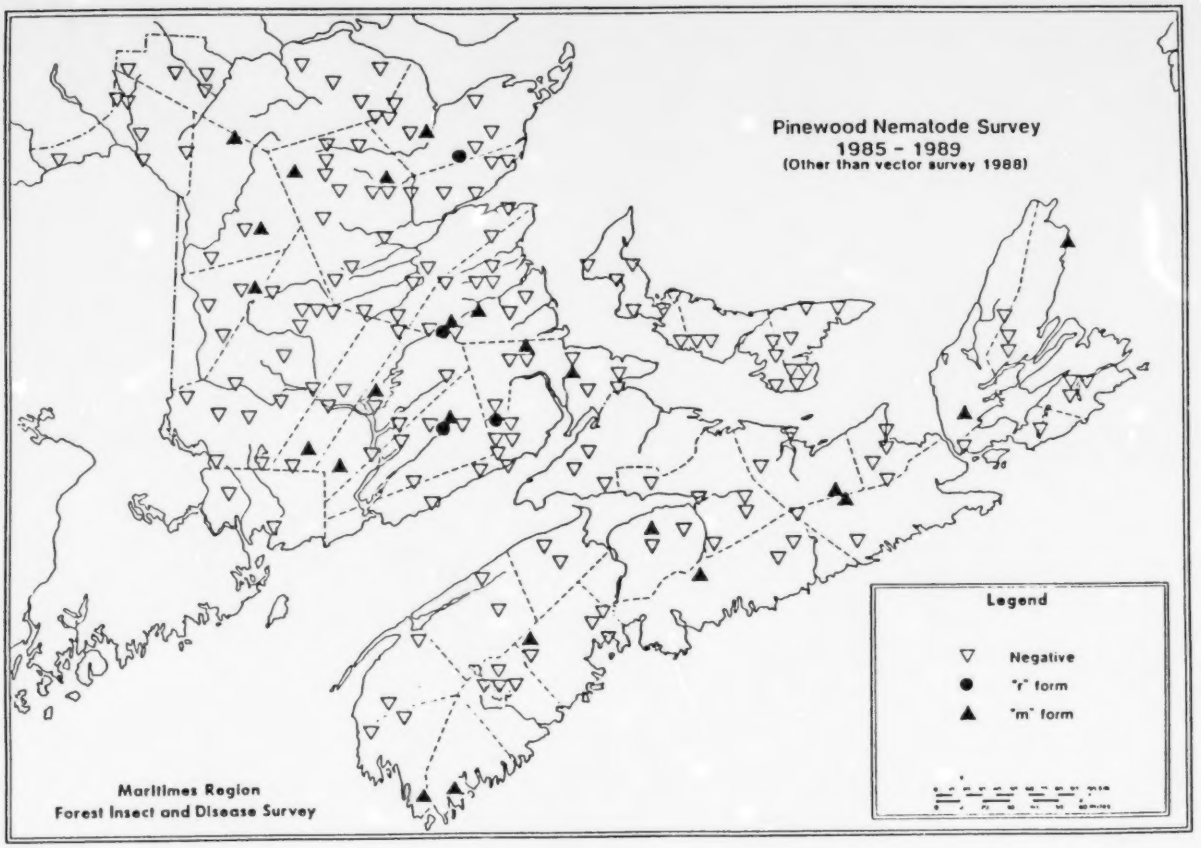
Pinewood nematode (either form) has been identified at 27 of the 228 locations (11.8%), from 32 of the 418 trees (7.6%) sampled. The so-called "r" form has been found at five locations (2.2%) in seven trees (1.7%) sampled. All were identified from New Brunswick and all came from dead pine trees. The so-called "m" form has been found at 23 locations (10.1%), 14 in New Brunswick (9.5% of 147 locations) and 9 in Nova Scotia (16.3% of 55 locations). Two trees were infested at two locations; only individual trees were positive in the other areas. Of the 25 infested trees, 18 were balsam fir and one each of black spruce, red spruce, Scots pine, eastern white pine, and jack pine. All but one of the trees from which the "m" form was extracted were recently dead, the exception being an old-dead eastern white pine tree from Nova Scotia. Details are listed in Table 2. No pinewood nematode (either form) was found in Prince Edward Island.

Although all infested trees were dead, it is unlikely that any of them were killed by pinewood nematode. In most cases, the cause of death was easily attributable to definite factors, such as root rot, wind-throw, mechanical damage, etc., or death due to gradual deterioration following repeated defoliation. Also, in most cases, nematode numbers in samples were far too low to have been able to significantly affect the infested trees.

Balsam fir received special attention, especially in the early part of the survey, because of the similarity in symptom expression between Stillwell's Syndrome (the sudden wilting of balsam fir trees) and the supposedly sudden wilting of conifers killed by the pinewood nematode. Pinewood nematode has been identified from only a few of the balsam fir trees that succumbed to Stillwell's Syndrome.

Vector survey - 1988

A special pinewood nematode-vector survey was conducted in the Maritimes as part of a national effort during the summer of 1988. The purpose of the survey was to clarify the situation regarding wood-inhabiting insects as possible vectors (carriers) of the pinewood nematode.



Sampling was done according to an established national protocol to ensure uniformity across Canada. Insects were collected in the forest, on slash or on log piles in cut-over areas, on logs, bark- and chip-piles in mill yards, and even "on freshly hung laundry on a backyard clothesline". Most insects were picked up while resting, others were trapped in bottles baited with attractants, and some, mainly bark beetles, were reared in the laboratory from infested logs. Although most of the sampling was done by Forest Insect and Disease Survey personnel, many samples were also obtained through the cooperation of staff of provincial forestry services, lumber mills, industrial companies, municipalities, and interested private individuals.

Although most samples consisted of single collections at particular locations, a special effort was expended on repeated collecting in the Nevers Brook, Kent County, N.B., area, where the "r" form of the pinewood nematode was found both in 1986 and 1987, even though in only a very few trees.

The vector survey in the Maritimes yielded 1676 specimens, representing 38 insect species in 6 families, in 260 collections from 151 locations. Of the insects collected, 274 were various species of sawyer beetles (Monochamus sp.), the "chief suspect"

Table 1. Summary of forest tree surveys for pinewood nematode in the Maritime Provinces of Canada 1985-1989

Tree species	Maritimes Region			New Brunswick			Nova Scotia			Prince Edward Island		
		PWN			PWN			PWN			PWN	
	Trees	r	m	Trees	r	m	Trees	r	m	Trees	r	m
Balsam fir	178	-	19	107	-	12	58	-	7	13	-	-
Jack pine	47	6	1	47	6	1	-	-	-	-	-	-
Red pine	13	-	-	6	-	-	6	-	-	1	-	-
Scots pine	18	-	1	12	-	-	5	-	1	1	-	-
White pine (eastern)	41	1	1	18	1	-	19	-	1	4	-	-
Black spruce	53	-	2	21	-	-	29	-	2	3	-	-
Red spruce	16	-	1	8	-	1	8	-	-	-	-	-
Sitka spruce	1	-	-	-	-	-	-	-	-	1	-	-
White spruce	50	-	-	14	-	-	6	-	-	30	-	-
Larch	1	-	-	-	-	-	-	-	-	1	-	-
Total number of trees sampled	418	7	25	233	7	14	131	-	11	54	-	-
No. of locations sampled	228	(27)		147	(18)		55	(9)		26	(0)	

PWN - pinewood nematode
r, m - "r" or "m" form of Bursaphelenchus xylophilus

among possible vectors of the pinewood nematode. All specimens were shipped by air to ensure that they arrived alive at Memorial University, St. John's, Newfoundland, for preparation and expert identification (Magasi, 1989).

No pinewood nematode was found in any of the insects submitted from the Maritimes as part of the national vector survey.

CONCLUSION

There is no evidence that the "pine wilt disease", which has caused damage to forests in some parts of the world, exists in the Maritime provinces of Canada, even though pinewood nematode-infested fir, spruce, and pine trees occur in both New Brunswick and Nova Scotia.

There is no evidence to justify pinewood nematode in the Maritimes as an organism of biological importance to forest health (i.e., a tree killer). However, the consequences of its presence could become economically significant if it affects our ability to export forest products because of plant quarantine related regulations in other countries.

Table 2. Occurrence of pinewood nematode in forest trees in the Maritime Provinces of Canada

County		Tree Species	Tree Condition	Pinewood Nematode Infested tree	Pinewood Nematode Form
New Brunswick					
Albert	Pleasant Mountain	wP	RD	1	r
Carleton	Juniper	bF	RD	1	m
Gloucester	Jeanne Mance	jP	RD	2	r
	Sugary Brook Rd.	bF	RD	1	m
Kent	Mortimer	bF	RD	1	m
	Nevers Brook #1	jP	RD	1	m
	Nevers Brook #1	jP	RD	1	r
	Nevers Brook #2	jP	RD	1	r
	Nevers Brook #2	jP	OD	1	r
Kings	Hebron Mountain	jP	RD	1	r
	Smiths Creek	bF	RD	1	m
Northumb.	Bubar Brook	bF	OD	1	m
	Little River	bF	RD	1	m
Queens	Petersville, Broad Rd.	bF	RD	1	m
	Coy Road	bF	RD	1	m
Sunbury	Blissville area	rS	RD	1	m
Victoria	Sadler Brook	bF	RD	1	m
	Sisson Branch	bF	RD	1	m
Westmorland	Malakoff	bF	RD	1	m
	Shaw Brook	bF	RD	1	m
Nova Scotia					
Guysborough	Garden of Eden Barrens	scP	RD	1	m
Halifax	Devon	bF	RD	1	m
Hants	Stanley Mgmt Unit	bS	RD	1	m
Inverness	River Denys Rd	bF	RD	1	m
Lunenburg	Simpson Corner	bF	RD	2	m
Pictou	Garden of Eden F Tower	wP	OD	1	m
Shelburne	Birchtown	bS	RD	1	m
	Oak Park	bF	RD	1	m
Victoria	Neils Harbour	bF	RD	2	m

r, m, - "r" or "m" form of Bursaphelenchus xylophilus
RD - recently dead tree; OD - old dead tree
bF - balsam fir (Abies balsamea); bS - black spruce (Picea mariana); rS - red spruce (Picea rubens); jP - jack pine (Pinus banksiana); scP - Scots pine (Pinus sylvestris); wP - eastern white pine (Pinus strobus).

References

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Magasi, L.P. 1989. Forest pest conditions in the Maritimes in 1988. Forestry Canada - Maritimes Region Info. Rep. M-X-174.

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